$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(e^{kx}) = ke^{kx}$

$\frac{d}{dx}(\sin x) = \cos x$

$\frac{d}{dx}(\cos x) = -\sin x$

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$\frac{d}{dx}(\csc x) = -\csc x \cot x$

$\frac{d}{dx}(fg) = f'g + fg'$ $\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{f'g - fg'}{g^2}$

day 26

Quiz Tomorrow*: chapter 2 only

$\sec x^2$ means $\sec(x^2)$

$x \longmapsto x^2 \longmapsto \sec(x^2)$

$(\sec x)^2$ means $\sec^2 x$

$x \longmapsto \sec x \longmapsto (\sec x)^2$

$\sec^2 x$ is a convention.
Square the secant, not the x

day 26

$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(fg) = f'g + fg'$

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3.4/44) $g(t) = 2te^{t/2}$

$g'(t) = 2\left[\frac{d}{dt}(t)\cdot e^{t/2} + t\cdot\frac{d}{dt}(e^{t/2})\right]$

$= 2\left[1\cdot e^{t/2} + t\left(\frac{1}{2}e^{t/2}\right)\right]$

$= 2e^{t/2} + te^{t/2}$

note:
$e^{t/2} = e^{(1/2)t}$

$\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(fg) = f'g + fg'$ $\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{f'g - fg'}{g^2}$ day 26

$\frac{d}{dx}(e^{kx}) = ke^{kx}$

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3.5/2 How is $\lim_{x \to 0} \frac{\sin x}{x}$ used in this section

→ to assist in calculating the limit of $\lim_{x \to 0} \frac{\sin(mx)}{\sin(nx)}$ or $\lim_{x \to 0} \frac{\sin(mx)}{x}$

→ to enable us to calculate the derivative of $\sin x$

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$\frac{d}{dx}(x^n) = nx^{n-1}$

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day 26

3.5/5) Let $f(x) = \sin x$.

$f'(\pi) = f'(x)\Big|_{x=\pi} = \frac{d}{dx}(\sin x)\Big|_{x=\pi}$

$= \cos x\Big|_{x=\pi} = \cos \pi = -1$

$f'(x)\Big|_{x=\pi}$

find derivative

... when x takes on the value of π

evaluate result

day 26

$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(fg) = f'g + fg'$

$\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{f'g - fg'}{g^2}$

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3.5/10

$$\lim_{x\to 0} \frac{\sin(3x)}{\tan(4x)} = \lim_{x\to 0} \frac{\sin(3x)}{\frac{\sin(4x)}{\cos(4x)}}$$

$$= \lim_{x\to 0} \frac{\sin(3x)}{1} \cdot \frac{\cos(4x)}{\sin(4x)}$$

$$= \lim_{x\to 0} \frac{\sin(3x)}{\sin(4x)} \cdot \frac{\cos(4x)}{1}$$

$$= \lim_{x\to 0} \frac{3 \cdot \frac{\sin(3x)}{3x}}{4 \cdot \frac{\sin(4x)}{4x}} \cdot \frac{\cos(4x)}{1} = \frac{3}{4}$$

$\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(fg) = f'g + fg'$ $\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{f'g - fg'}{g^2}$ day 26

$\frac{d}{dx}(e^{kx}) = ke^{kx}$

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3.5/5+1

where does the graph of $\sin x$ have a horizontal tangent? [slope = 0]

$\frac{d}{dx}(\sin x) = \cos x$

where does $\cos x = 0$?

$\frac{\pi}{2} \pm n\pi$

where does $\cos x$ have horiz tangent?

$\frac{d}{dx}(\cos x) = -\sin x$

$-\sin x = 0$ WHEN $\sin x = 0$ WHICH is $x = 0 \pm n\pi$

what are the connections? THM

$\frac{d}{dx}(x^n) = nx^{n-1}$

$\frac{d}{dx}(e^{kx}) = ke^{kx}$

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day 26

INETM

3.5/8

$$\lim_{x\to 0} \frac{\sin(5x)}{3x}$$

$$= \lim_{x\to 0} \left(\frac{1}{3}\right)\frac{5\sin(5x)}{5\cdot x} = \lim_{x\to 0} \left(\frac{5}{3}\right)\frac{\sin(5x)}{(5x)}$$

$$= \left(\frac{5}{3}\right)(1) = \frac{5}{3}$$

$$\lim_{\text{banana}\to 0} \frac{\sin(\text{banana})}{\text{banana}} = 1$$

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$\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(fg) = f'g + fg'$ $\frac{d}{dx}\left(\frac{f}{g}\right) = \frac{f'g - fg'}{g^2}$

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Limits

* substitute first

($\frac{0}{0}$, $\frac{\infty}{\infty}$ tell you, you don't know limit)

limits with radicals

divide by x or $\sqrt{x^2}$ or $|x|$

* $\lim_{x \to a} f(x) = \begin{cases} +\infty \\ 0 \\ -\infty \end{cases}$: definition of vertical asymptote

* $\lim_{x \to \begin{cases} +\infty \\ -\infty \end{cases}} = L$: definition of horizontal asymptote

* techniques to "reduce" a function to a limit that is not $\frac{0}{0}$ or $\frac{\infty}{\infty}$

→ cancel zeros or infinities
- factor
- multiply by conjugate (top & bottom)
- multiply by radical (top & bottom)

* remember:
2 sided limit relies on Both 1-sided limit

* know definition [[checklist]] of continuity

day 26

$\frac{d}{dx}(x^n) = nx^{n-1}$

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